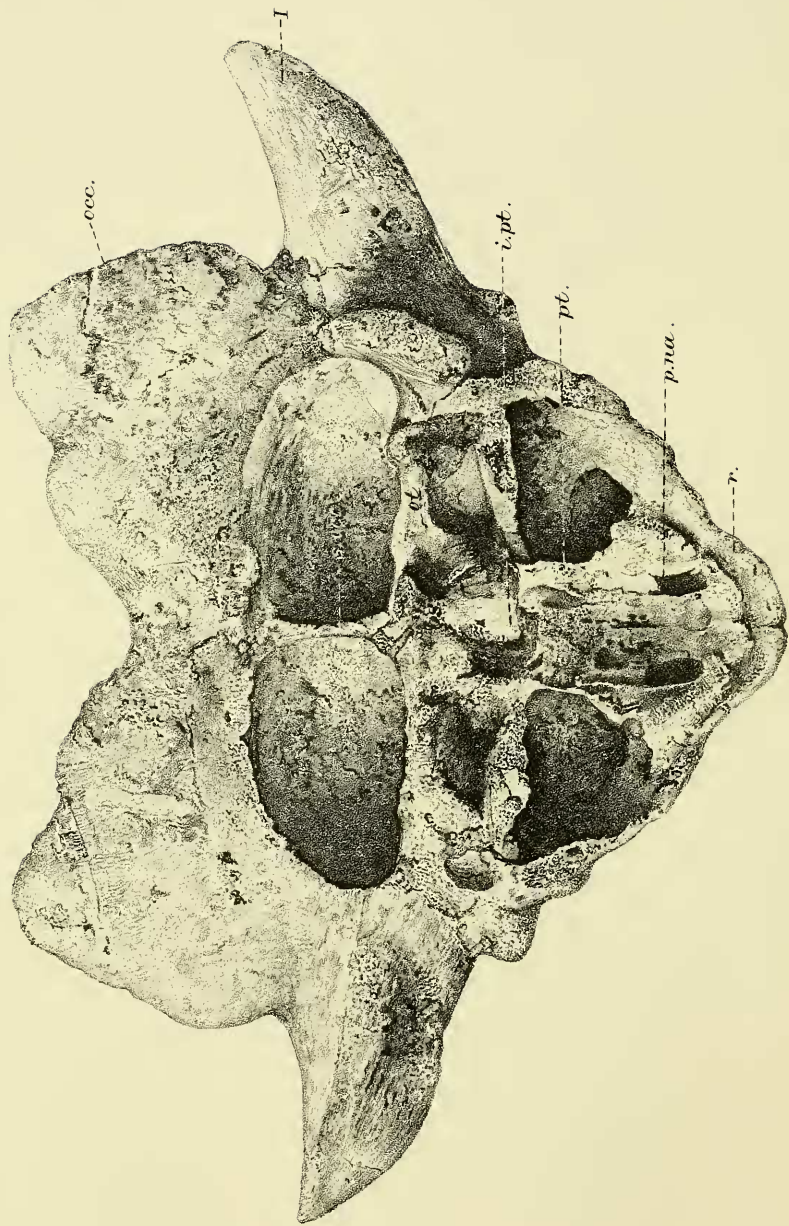
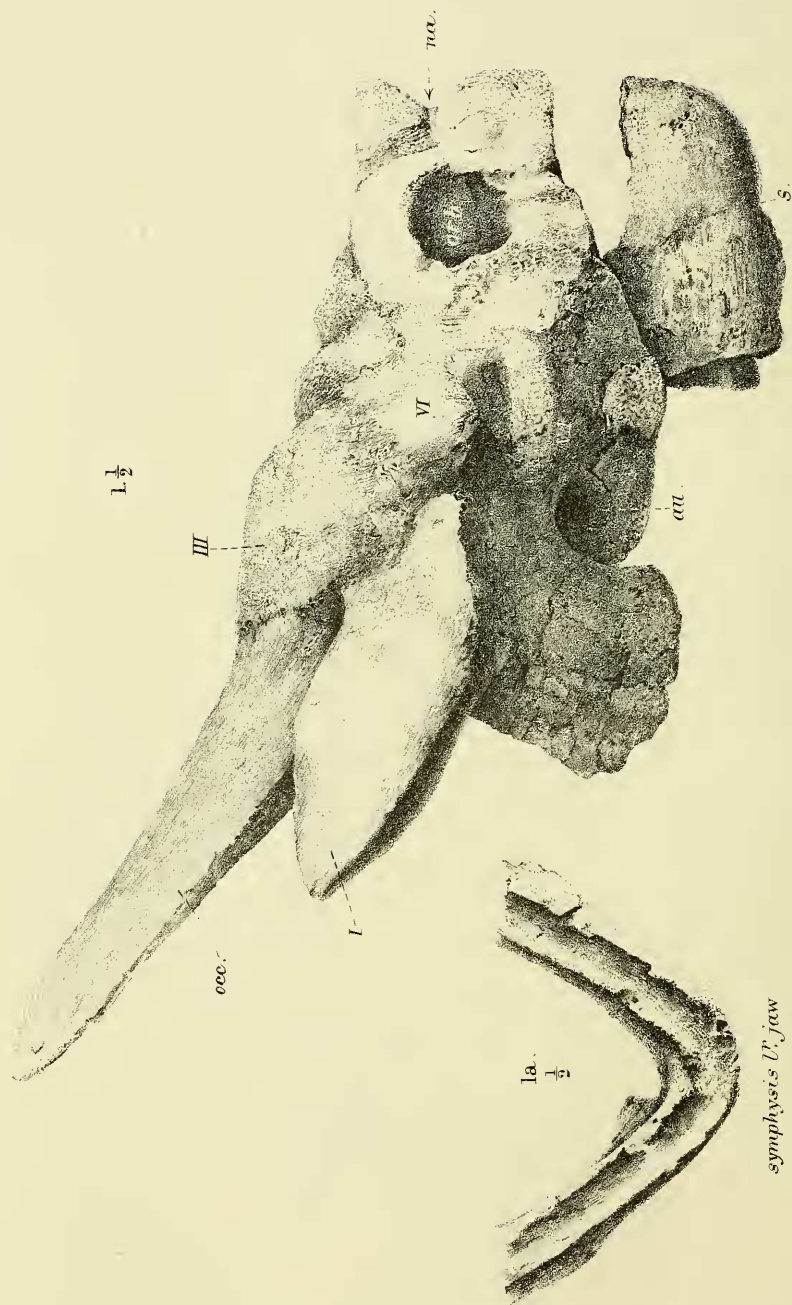


MIOLANIA ARGENTINA.  
*Cranium upper aspect, 1/3 nat. size.*

Minibern, Eros. imp.

J Green del. et lith.

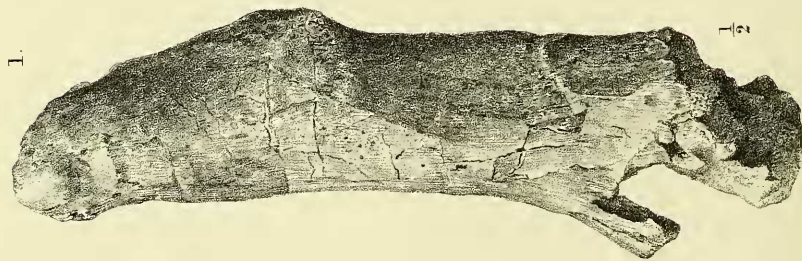




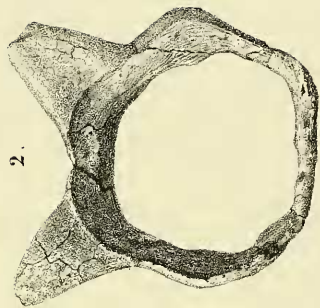
MIOLANIA ARGENTINA.  
Profile of skull,  $\text{sc. } \frac{1}{4}$  nat. size.

Mintner, Bros. imp.

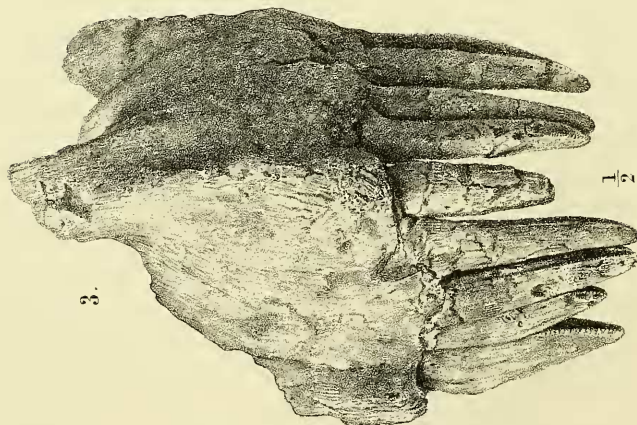
J. Green del. et lith.



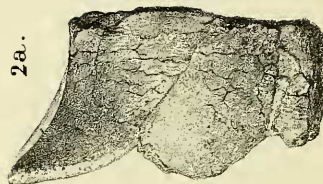
$\frac{1}{2}$



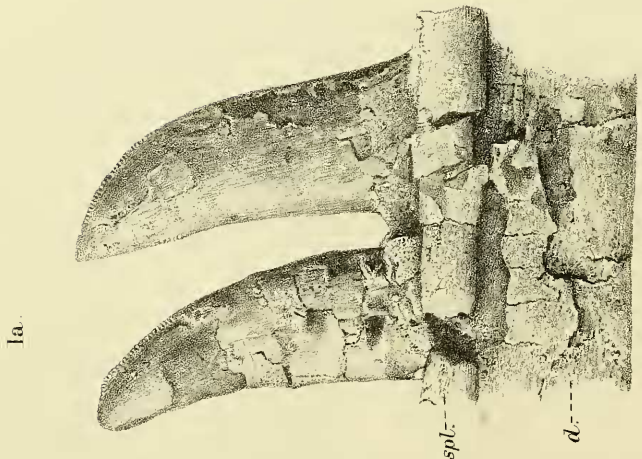
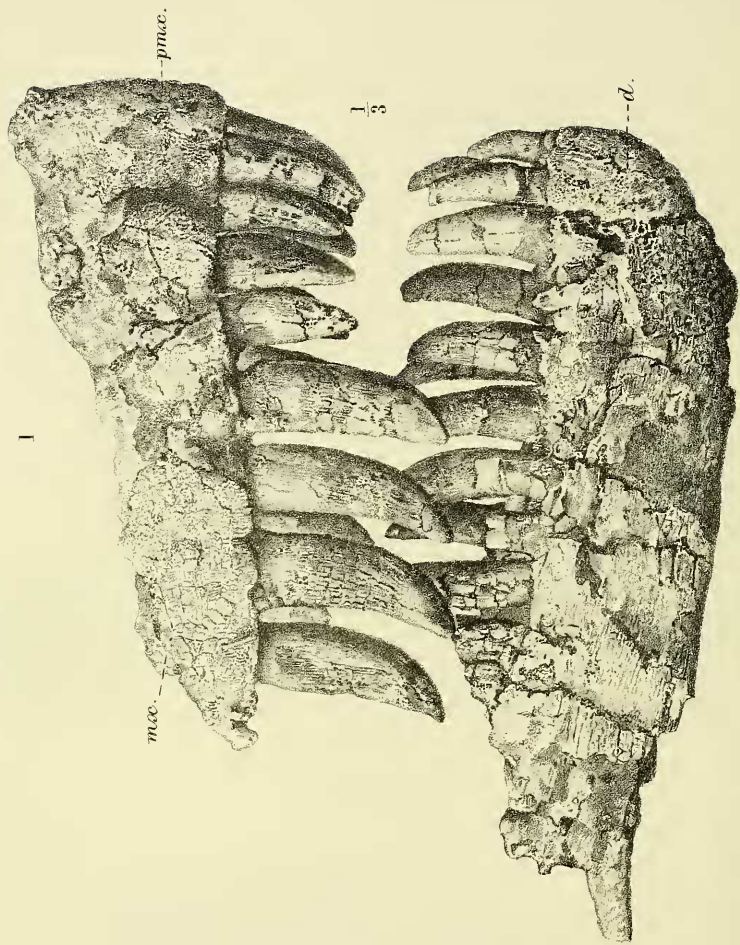
$\frac{1}{2}$

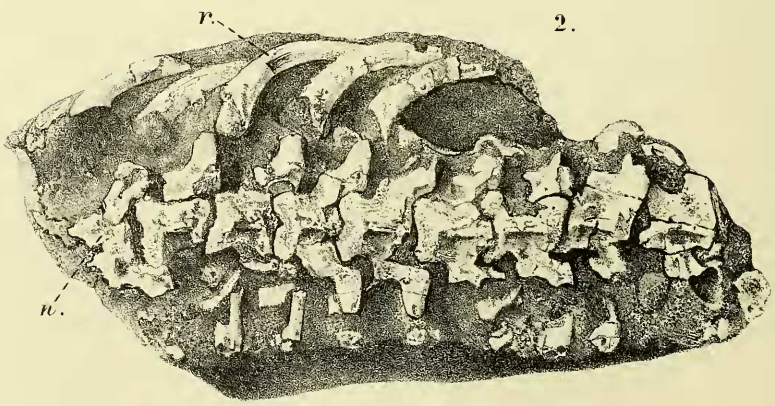
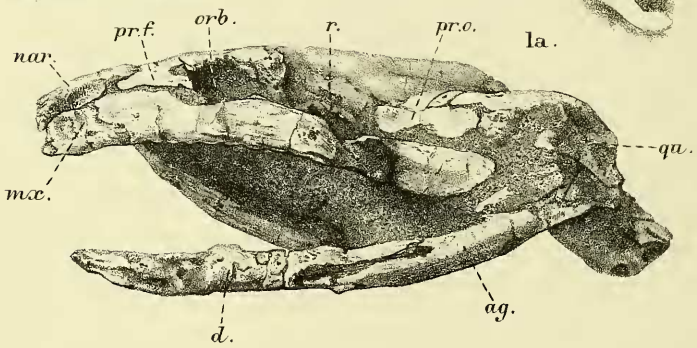
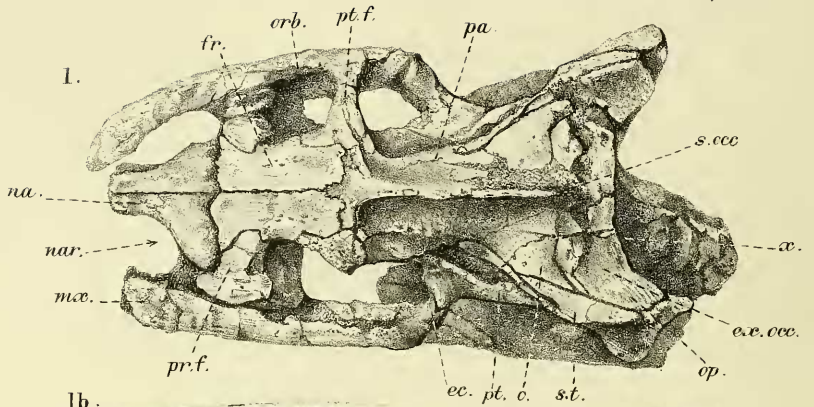


$\frac{1}{2}$



$\frac{1}{3}$





specimen of one of the large Bird-catching Spiders (*Avicularia*). This Spider did well up to the end of August last, when it died soon after casting its "skin." This skin, which is perfect, I exhibit. The Spider itself was so soft when it died that I could not set it.

The process of casting the "skin" amongst the large Spiders is a very trying one, and most of the specimens we have had have died during the process or soon after.

On behalf of Captain Stanley Flower, F.Z.S., Mr. Sclater exhibited photographs of three fine animals living in the Zoological Garden at Ghizeh, taken by Captain F. H. Mackenzie, of the Army Pay Department. Mr. Sclater remarked that the photo of the young female Giraffe (*Giraffa camelopardalis typica*) and that of the young male White Oryx (*Oryx leucoryx*) represented the specimens brought by Captain Flower from the Soudan last year; the photo of the fine adult male Ostrich was of special interest as showing the vocal sac (text-fig. 48, p. 168) as extended in the breeding-season.

On behalf of Dr Einar Lönnberg, two photographs of the largest skull of the East Greenland Musk-ox obtained during Mr. G. Kolthoff's expedition were exhibited. The dimensions of the specimen were:—

Basal length . . . . .	460 millim.
Greatest orbital length . . . . .	280 "
Greatest occipital width . . . . .	187 "
Length of boss of each horn . . . . .	205 "

The following papers were read:—

1. On some Extinct Reptiles from Patagonia, of the Genera *Miolania*, *Dinilysia*, and *Genyodectes*. By A. SMITH WOODWARD, LL.D., F.R.S., F.Z.S.

[Received March 1, 1901.]

(Plates XV.—XX.<sup>1</sup>)

To the north of Patagonia there is a widely distributed formation of red sandstone, supposed to be of Cretaceous age, containing important remains of extinct Reptiles in association with equally remarkable fragments of extinct Mammals. Many of these fossils have been skilfully collected by Mr. Santiago Roth for the La Plata Museum; while some of them, belonging to gigantic Dinosaurs and small Mesosuchian Crocodiles, have already been the subject of illustrated monographs<sup>2</sup>. A few of the most

<sup>1</sup> For an explanation of the Plates, see p. 183.

<sup>2</sup> R. Lydekker, "The Dinosaurs of Patagonia," *Anales Mus. La Plata—Paleont. Argentina*, no. ii. (1893). A. Smith Woodward, "On two Mesozoic Crocodylians, *Notosuchus* (genus novum) and *Cynodontosuchus* (genus novum), from the Red Sandstones of the Territory of Neuquen," *ibid.* no. iv. (1896).

important reptilian fossils, however, still await description; and Dr. F. P. Moreno, Director of the La Plata Museum, has kindly entrusted them to me for detailed study, of which the results appear in the following pages. The new specimens represent a species of the extinct armoured Chelonian *Miolania*; an undescribed extinct genus of Ophidians; and a large carnivorous Dinosaur.

I. AN ARMoured CHELONIAN, *MIOLANIA ARGENTINA*.  
(Plates XV.—XVIII.)

In the autumn of 1898, Mr. Santiago Roth sent me a photograph of a bony ring of a tail-sheath from the red sandstone of Chubut, which Dr. Moreno and he regarded as most closely resembling the caudal armour of the extinct Australian Chelonian, *Miolania*<sup>1</sup>. Early in 1899, Dr. Moreno brought the actual fossil to London for comparison with the original specimens from Queensland and Lord Howe's Island, now in the British Museum, with the result that his determination of the Patagonian fragment seemed to be confirmed. Microscopical sections, however, failed to prove identity, probably because the structure of the tissue of the new specimen was not well preserved. Dr. Moreno therefore sent another expedition under Mr. Roth to the locality whence the caudal ring was obtained; and this party was so fortunate as to find and disinter not only the skull and mandible, but also considerable portions of the carapace of a similar animal. A preliminary notice of this discovery was published in September 1899 by Dr. Moreno<sup>2</sup>, who sent the original specimens for exhibition to the Dover Meeting of the British Association<sup>3</sup>. At the same time Dr. Florentino Ameghino<sup>4</sup> briefly recorded a similar discovery said to have been made by his brother Carlos Ameghino in the Guaranitic Formation of Sehuen and Chubut. He also placed his specimens in the family *Miolaniidæ*, but in a new genus and species, *Niolamia argentina*; although no detailed description was given to justify this arrangement.

*Skull and Mandible.*

The skull (Plates XV.—XVII.) is much depressed and triangular in shape, with the temporal fossæ completely roofed by bone, the orbits far forwards, and the single large narial opening terminal.

<sup>1</sup> R. Owen, "Description of Fossil Remains of two Species of a Megalanian Genus (*Meiolania*) from Lord Howe's Island," *Phil. Trans.* 1886, pp. 471-480, pls. xxix., xxx. Also "On Parts of the Skeleton of *Meiolania platyceps*, Owen," *ibid.* 1888 B, pp. 181-191, pls. xxxi.-xxxvii. A. Smith Woodward, "Note on the Extinct Reptilian Genera *Megalania*, Owen, and *Meiolania*, Owen," *Ann. Mag. Nat. Hist.* [6] vol. i. (1888), pp. 85-89.

<sup>2</sup> F. P. Moreno, "Note on the Discovery of *Miolania* and of *Glossotherium* (*Neomyglodon*) in Patagonia," *Geol. Mag.* [4] vol. vi. (1899), pp. 385-388.

<sup>3</sup> F. P. Moreno and A. Smith Woodward, "Exhibition of and Remarks on a Skull of the extinct Chelonian *Miolania* from Patagonia," *Rep. Brit. Assoc.* 1899 (1900), p. 783.

<sup>4</sup> F. Ameghino, *Sinopsis Geologico-Paleontologica—Suplem.* (1899), p. 10.



Its peculiar contour is evidently due to the fusion of large dermal ossicles with the bones of the cranial roof and cheeks; but all the sutures are obliterated, except on part of the palate.

The hinder third of the skull, as seen from above (Plate XV.), is merely an occipital crest (*occ.*) consisting of two antero-posteriorly compressed, almost laminar bosses of bone, which meet for half their depth in the middle line and fuse together. This crest seems to be solid and is firmly ankylosed with the occipital border of the skull, from which it inclines both upwards and backwards. It is attenuated to a sharp edge at its upper and lateral margins, which seem to be complete on the right side of the fossil; and its upper margin shows a rounded median excavation at the meeting of the two elements of which it is composed. On either side an extremely thin lamina of bone connects the basal half of the occipital crest with a bovine-horn-shaped boss (I.) which projects laterally from the cranium just above the hinder part of the quadrate bone. This postero-lateral prominence is well-preserved on each side of the fossil, and its extent equals that of the crest just described. It is triangular in section, its antero-superior face being largest and flattened; and it exhibits a slight curvature which causes its acute distal extremity to point both backwards and outwards. Immediately in front of the occipital crest there are three bosses completely extending from side to side of the cranial roof. Of these the median or interparietal one (II.) is the smaller and ovate in shape, with its long axis antero-posteriorly directed, and its upper face concave in the middle. Of the lateral (or parietal) pair (III.) only that on the right side is complete. It is trapezoidal in shape, about as broad as long, and gently rises into a slight, blunt prominence near its middle. It extends nearly as far forwards as the orbit (*orb.*), above which the cranial roof is also thickened. This thickening is separated by a constriction both from the nasal region, which is flattened, and from a small median triangular area in the frontal region, which is occupied by three low bosses—a pair (IV.) behind, a median one (V.) in front, all broader than long. At the base of the postero-lateral horn-shaped prominence on each side there is also a well-preserved, small, laterally-directed boss (VI.), which is depressed and is about on the same level as the roof of the orbit.

All the bosses just described are also visible in a side view of the skull (Plate XVII.), which exhibits a still smaller, antero-posteriorly elongated, rounded boss (VII.) on the cheek immediately in front of the auditory opening. As shown on both sides of the fossil, there is no excavation of the cheek-plates between the orbit and the auditory opening, but the line of the alveolar border is continued directly backwards to the quadrate bone. The nasal roof does not extend farther forwards than the premaxillæ, but the lateral margin of the terminal narial opening (*na.*) is excavated by a constriction between the nasal and maxillary bones. This constriction is continued as a groove to the anterior margin

of the orbit, which is a little longer than deep and of about the same size as the narial opening. The tympanic opening (*au.*) is almost quadrilateral and equilateral, with rounded angles. It is scarcely more than half as large as the orbit, and is specially remarkable as being bounded behind by a gently convex, thick plate of bone, which is as broad as deep. This bone is only preserved on the right side of the fossil, but even here is too imperfect for the determination of its constitution. It probably represents the hinder part of the quadrate and squamosal fused with a dermal bone.

Viewed from below (Plate XVI.), the cranium proper is seen to be a little broader than long, with the snout rounded, and a slight constriction of the sides below the orbits. The palatal expansion of the maxillæ and premaxillæ bears a large inner rounded ridge (*r.*) concentric with the comparatively acute margin of the jaw, thus indicating the herbivorous nature of the animal. The roof of the mouth between this tritural border is raised into a dome with the concavity downwards. The posterior nares (*p.na.*) thus face backwards rather than downwards, and are separated by a broad flattened bar, which seems to be formed by the premaxillæ in front and by the vomer behind. Immediately behind the posterior nares, the antero-posteriorly arched area, which appears to be an unusually large vomer, bears a sharp median longitudinal keel. The limits between all the elements are uncertain, but the palato-pterygoid region (*pt.*) of the palate is relatively very short and broad, while the lateral margin of the pterygoid, though incomplete on both sides, exhibits no trace of the curious rolled-up lateral process so characteristic of existing Pleurodira. The pterygoids clearly meet in the middle line, and there is a small, transversely extended interpterygoid vacuity (*i.pt.*). The relatively small basisphenoid (*b.s.*) is not quite in the same plane as the basioccipital, but inclines a little upwards in front. A long narrow buttress extends outwards from it on either side to the portion of the quadrate bone which would bear the articulation for the mandible; but this region is too imperfect for precise interpretation. The buttress is fused postero-superiorly with the otic bones (*ot.*), which form a great mass at the sides of the occiput in which no sutures are discernible. The basioccipital is concave on its lower face; and the occipital condyle, of uncertain constitution, is about twice as broad as deep. The foramen magnum is slightly deeper than broad, but comparatively small. The median crest of the supraoccipital (*s.occ.*) is a slender lamina, somewhat expanded above where it fuses with the roof of the temporal fossæ. Neither this nor any of the otic bones extend backwards beyond the plane of the occipital crest.

The inner part of the cranium is well divested of matrix, and two other interesting features are thus exposed. The hinder part of the pterygoid is connected with the parietal region by a small vertical lamina of bone on either side. The nasal cavity is completely separated from the orbit on each side by a thin bony

septum, resembling that which in *Chelys* and *Chelodina* is formed by a downward process of the prefrontal joining the palatine.

Of the mandible (Plate XVII.) only the dentary-splénial portion is preserved, with a fragment of the articulo-angular on each side. The two rami are firmly fused at the symphysis (fig. 1 *a*), which is gently rounded and not produced into a beak. The oral margin is impressed with a broad, rounded groove, which is bordered inside and outside by a rather acute edge. The limit of the horny sheath is indicated by a distinct constriction (*s.*) on each ramus, which extends across the dentary obliquely downwards and forwards.

#### *Scapula.*

Except the scapulæ, all remains of the appendicular skeleton are too imperfect for description. The scapula of the right side (Plate XVIII. fig. 1) is nearly complete distally, while that of the left side is better preserved proximally. The bone is rather stout and laterally compressed, with a flattened outer face and an expanded proximal end. The latter portion closely resembles the proximal end of the scapula of *M. platyceps* in the British Museum. The tuberosity (*t.*) is remarkably prominent, while the contracted distal end is rounded.

#### *Carapace.*

The remains of the shell are very fragmentary, and parts only of the carapace can be recognized with certainty. The specimens are insufficient to determine the original degree of convexity of the armour, the pieces being not only too small but also probably a little distorted in fossilization. The trunk, however, seems to have been somewhat depressed. The bone of the carapace is thin, and its irregular outer face shows that it was completely covered with epidermal shields. The borders of the investing shields are marked on the carapace either by deep rounded grooves, or by differences in the elevation of the bone beneath adjoining shields.

The largest fragment represents the left postero-lateral portion of the carapace, and indicates that there were no fontanelles between the costal and marginal bones. As preserved, its convexity is very slight, while its outer face exhibits irregularities which denote the borders of the last vertebral and costal and three marginal shields. The edge of the row of marginal bones is excavated at intervals, so that the carapace is bordered by a series of large triangular prominences. The sutures between the component elements cannot be distinguished even on the inner face; but this aspect of the fossil is interesting as showing the expanded upper end of the relatively small left ilium fused with a costal bone. *Miolania* is thus proved to have been Pleurodiran in the fixation of its pelvis.

#### *Caudal Sheath.*

The bony ring of a tail-sheath (Plate XVIII. fig. 2), originally discovered by Mr. Santiago Roth in 1897, is fractured at its

anterior margin, but is nearly complete at its overlapping hinder border. It evidently consists of three pairs of scutes firmly fused together, their lines of union on the outer face being marked by slight longitudinal grooves. As seen in end view (fig. 2), the ring is only very slightly wider than deep, and its form is rather hexagonal than cylindrical. The lower pair of scutes constitutes the flattened base of the ring, and curves upwards on either side to form the lower margin of the lateral face. Each of the lateral pairs of scutes tapers backwards into a blunt triangular prominence, which reaches very slightly beyond its hinder, overlapping facette. The upper scutes, forming the roof of the ring, are produced backwards and upwards into a divergent pair of antero-posteriorly compressed, pyramidal bosses, which project considerably above and behind their overlapping facette. Externally (fig. 2*a*), all these scutes are quite smooth; internally, they do not exhibit any trace of contact or connection with the endoskeleton. As already mentioned, the microscopic structure of the bony tissue seems to have been destroyed.

Part of a second caudal ring, of similar type, was discovered along with the imperfect skeleton in 1899.

#### *Generic and Specific Determination.*

If the South American fossil skull and mandible now described be compared with the corresponding parts of the type species of *Miolania*, *M. platyceps*, from Lord Howe's Island, a remarkable resemblance in all essential features is observable. The skull of *M. platyceps* is nearly similar in shape, with its temporal fossæ completely roofed by bone, and its external contour modified by the fusion of dermal, bony bosses with several of its elements. It exhibits the same broad plate of bone on the cheek behind the tympanic cavity, a precisely similar palate, and the complete laminar septum between the nasal chamber and the orbit. Moreover, the nasal bones in *M. platyceps* scarcely project farther forwards than the premaxillæ. Several minor differences, however, may be noted. In *M. platyceps* all the bosses are relatively much smaller than in the new fossil. The occipital pair are two well-separated small thick bosses, apparently solid and connected with the postero-lateral "horns." The latter are ovoid or rounded in section, turned upwards as much as outwards, and considerably smaller in two of the specimens described and figured by Owen<sup>1</sup> than in a third specimen<sup>2</sup>, which has also been described by Huxley under the name of *Ceratochelys sthenurus*<sup>3</sup>. Except the interparietal, all the bosses seen in the South American specimen also appear to have slight representatives in *M. platyceps*; but the latter exhibits an additional small prominence antero-inferiorly at the

<sup>1</sup> Phil. Trans. 1888 B, pls. xxxi.-xxxiv.

<sup>2</sup> Phil. Trans. 1886, pl. xxx.

<sup>3</sup> T. H. Huxley, "Preliminary Note on the Fossil Remains of a Chelonian Reptile, *Ceratochelys sthenurus*, from Lord Howe's Island, Australia," Proc. Roy. Soc. vol. xlii. (1887), pp. 232-238.

base of the postero-lateral "horn." The premaxillo-maxillary border of the palate in *M. platyceps* is also peculiar in bearing two sharp inner ridges concentric with the acute oral margin, instead of the one blunt ridge present in the new fossil; and there are indications of a slight pit for the reception of a pointed mandibular beak on the oral face of the premaxillæ. In conformity with this arrangement, the mandible is bevelled on its outer face at the oral margin. Finally, the nasal chamber in *M. platyceps* is partly divided by a vertical median septum.

The type skull of the comparatively large *Miolania oweni*, from the Pleistocene of Queensland, has been considerably mended and improved since it was described and figured by Owen<sup>1</sup>. It is now possible to observe most of its distinctive features; and comparison shows that in nearly all the particulars in which it differs from the new South American fossil, it agrees with *M. platyceps*. It is slightly less depressed than the latter, and its dermal bosses are relatively larger. The occipital crest does not occupy more than one quarter of the total length of the upper face of the skull; its two bosses are less antero-posteriorly compressed and less fused together than in the specimen now described; while they are peculiar in being hollow—possibly, however, by accidental disintegration in the fossil. The postero-lateral horns are ovoid in transverse section and point directly outwards, not being curved at the apex. They bear the small supplementary boss at the base, already mentioned in *M. platyceps*; and the interparietal dermal plate is absent, as in the latter species, while the parietal bosses are relatively very large. The bony lamina of the cheek behind the tympanic cavity is well preserved on the right side and evidently consists in large part of two fused dermal bones. The premaxillo-maxillary border of the palate agrees with that of *M. platyceps* in bearing two sharp inner ridges concentric with the acute oral border; and the premaxillary pit for the symphyseal beak of the mandible is especially deep<sup>2</sup>. The median bony septum of the nasal chamber is incomplete, and thus intermediate in development between the conditions observed in the species from Lord Howe's Island and Chubut. The nasal bones differ from those of both these species in projecting forwards considerably beyond the premaxillæ.

It is thus evident that the new South American skull differs very little from that of the two Australian species of *Miolania* except in the relative development of its main features. It seems to lack one small pair of dermal bosses which are present in the latter. It differs more considerably in the comparatively simple ridging of the border of the palate and the absence of a sharply pointed beak at the symphysis of the mandible. The additional boss, however, is merely produced by a notching of the base of the postero-lateral "horn"; and Mr. Boulenger has pointed out to

<sup>1</sup> Referred to *Megalania prisca* by Owen, Phil. Trans. 1880, p. 1041, pls. xxxvii., xxxviii.

<sup>2</sup> Imperfectly shown by Owen, *loc. cit.* 1880, pl. xxxviii. fig. 3.

me that the relative development of the mandibular beak varies considerably in the Cryptodiran genus *Chelone* and in the Pleurodiran genus *Sternotherus*, while some species of *Podocnemis* have two marginal palatal ridges, others have only one. I therefore conclude that there is not yet sufficient reason to separate the South American species now made known from the genus *Miolania*, hitherto discovered only in the Australian region. It must be regarded merely as forming a very distinct species, characterized by the much-depressed form of the cranium, the enormous size of the occipital crest, the triangular shape of the postero-lateral "horns," the simple rounded ridge on the palate, and the total absence of an internasal septum. It may be appropriately named, following Ameghino, *Miolania argentina*.

It will also be observed that Mr. Boulenger's determination of the Pleurodiran nature of the genus *Miolania*<sup>1</sup> is now completely established.

## II. AN EXTINCT OPHIDIAN, *DINILYSIA PATAGONICA*, gen. et sp. nov. (Plate XX.)

Mr. Roth's discovery of a fossil Ophidian in the red sandstone of Neuquen, associated with typical Mesosuchian Crocodiles, has already been recorded<sup>2</sup>; but the unique specimen referred to has not hitherto been studied. It comprises the greater part of the skull and mandible, and fragmentary remains of the anterior half of the vertebral column; the cranium being in an especially good state of preservation.

The skull (Plate XX. figs. 1, 1*a*) is long, narrow, and depressed, with the cranial region as long as the facial region. It seems to have been widest at the occiput, where the otic region is very massive; and the maximum compression is immediately in front of this, where the parietals rise into a prominent sagittal crest. The constitution of the hinder part of the skull is best seen on the left side of the fossil, where there is only one slight antero-posterior crack (*x*) in the bones. The right postero-lateral angle, on the other hand, is fractured and displaced downwards. The foramen magnum, which is filled with matrix, is completed above by the exoccipitals (*ex.occ.*), which meet in the middle line. They are directly continuous on each side with a great, expanded piece of bone (*op.*), which curves backwards as well as outwards and abuts upon the bone at the upper end of the quadrate. This expansion of the exoccipital is probably the opisthotic, which is similarly fused with the exoccipital in Lacertilia and the extinct Mosasaurs. Above the exoccipitals is the short but laterally-extended supraoccipital (*s.occ.*), which completes the sagittal crest behind. Its lateral extremity on the left is in contact with a small trace of bone (*o.*),

<sup>1</sup> G. A. Boulenger, "On the Systematic Position of the Genus *Miolania*, Owen (*Ceratochelys*, Huxley)," P. Z. S. 1887, pp. 554, 555. Also "Remarks in reply to Dr. Baur's Article on the Systematic Position of *Miolania*," Ann. Mag. Nat. Hist. [6] vol. iii. 1889, pp. 138-141.

<sup>2</sup> A. Smith Woodward, Anales Mus. La Plata—Paleont. Argent. no. iv. (1896), p. 1.

which is exposed between the opisthotic, parietal, and the bone at the upper end of the quadrate. The fragment is doubtless the highest point of the anterior otic bone, of which the upper part is otherwise completely buried by the surrounding elements. The parietals (*pa.*) occupy nearly half the entire length of the cranium, curve downwards to form the side walls, are much compressed in their anterior two-thirds, and rise into a conspicuous sagittal crest. They are flattened in the middle line at their anterior end, and are not pierced by a pineal foramen. Each of the frontals (*f.*) is nearly three times as long as broad, and slightly widest at its truncated anterior end. There is no supraorbital bone; but posteriorly and anteriorly the outer border of the frontal is slightly notched for the accommodation of the postfrontal and prefrontal respectively. The postfrontal (*pt.f.*) seems to have partly bounded the comparatively small orbit (*orb.*) behind; but this bar is broken away on both sides. The prefrontal (*pr.f.*), best preserved on the left (fig. 1 *a*), is flattened and triangular in shape, almost equilateral; it is only slightly in contact with the postero-lateral angle of the nasal bone. The nasals (*na.*) are also flattened and triangular in shape, but antero-posteriorly elongated and with a somewhat concave outer side which bounds the relatively large narial opening (*nar.*). They are widest at their articulation with the frontals. They are incomplete in front, and the premaxillæ are unfortunately not shown. The greater part of the palate is obscured by matrix or broken away, but some features at the postero-lateral angles of the cranium and in the facial region are well shown. As observed especially on the left side (fig. 1), a long and narrow plate of bone (*sl.*) forms the postero-superior boundary of the parietal and otic region, and seems to constitute the articulation for the quadrate. This is doubtless the element commonly named supratemporal in Snakes, Lizards, and Mosasaurs. The quadrate (*qu.*) is evidently short and broad, but is only imperfectly shown in section on the left side. Its remains (Pl. XX. fig. 1 *c*) are not readily interpreted; but the upper end of the bone seems to be displaced outwards and incomplete in the fossil, while the more expanded lower end shows the large notch which usually forms a loose articulation for the pterygoid in Snakes. At first sight, it might be supposed that the quadrate was of the same form as that of the Mosasaurs, with a deep posterior notch for the auditory meatus; but closer study seems to make this interpretation impossible. At the side of the cranium, below the supratemporal and parietal, the upper border of a large prootic (*pr.o.*) is exposed; while between this bone and the orbit the downwardly curved portion of the parietal forms a sharp longitudinal lateral ridge (*r.*). There are no traces of temporal arcades. The short pterygoids (*pt.*) are partly exposed, and a portion of the palatine below the orbit on the left side bears traces of two comparatively minute teeth. There are distinct remains of an ectopterygoid or transverse bone (*ec.*) on each side between the pterygoid and maxilla; and a fragment on the left side seems to

show that this element overlapped the maxilla to a considerable extent. The maxilla itself (*ma.*) is relatively large, and best preserved on the right side. It is stout and curves inwards in front. It articulates not only with the pterygoid behind by the intervention of the transverse bone, but also with the palatine by a broad articular palatal process which extends inwards from its middle. It likewise articulates directly with the prefrontal in an extensive suture. It shows 14 or 15 large shallow sockets for the implantation of teeth (fig. 1 *b*); and one dental crown preserved at the hinder end of the left maxilla is very slender and recurved. The fragmentary remains of the mandible show it to have been of the usual slender ophidian type, with a very loose articulation between the dentary (*d.*) and articulo-angular region (*ag.*); and the dentary exhibits a series of large shallow tooth-sockets like those of the maxilla.

Behind the skull there are remains of a long series of typical ophidian vertebræ, which do not present any features worthy of special note. The neural arches are shown to have borne delicate low spines, though nearly all of these have been broken away and are only represented by their bases in the fossil (Plate XX, fig. 2, *n.*). The ribs (*r.*) are very stout.

From this description it is evident that the Patagonian fossil in question represents a typical member of the order Ophidia. As shown, however, by the conformation of the occiput and the relatively small size of the quadrate, it belongs to one of the more generalized types. Its closest allies may therefore be sought among the Boidæ and Ilysiidæ, which still constitute so large and characteristic a part of the Ophidian fauna of South America. The skull bears much general resemblance to that of a *Boa constrictor*, but is readily distinguished from the latter by its non-projecting supratemporal and relatively small quadrate. It is similarly distinguished from the skull of all the other Boidæ<sup>1</sup>. In precisely this character, on the other hand, the fossil skull agrees with that of the existing Ilysiidæ; and its occipital region is almost identical with that of the South American genus *Ilysia*<sup>2</sup>. The resemblance to the latter, indeed, is so close that, although the coronoid region of the mandible is not observable in the fossil, there need be little hesitation in referring the extinct type now described to the family Ilysiidæ. It differs from the existing genera of the family in its more numerous marginal teeth and relatively smaller palatine teeth; in its elevated sagittal crest; and in the presence of well-developed neural spines on the vertebræ. It also differs from the South American *Ilysia*, though agreeing with the Javan *Cylindrophis*, in the possession of a small postfrontal bone. It may, in fact, be regarded as a comparatively gigantic forerunner of the Ilysiidæ, analogous to *Glyptodon* among the Armadillos and *Phororhachos* among the Cariamas.

<sup>1</sup> G. A. Boulenger, Catalogue of the Snakes in the British Museum (Natural History), vol. i. (1893).

<sup>2</sup> G. A. Boulenger, *tom. cit.*, (1893), p. 132, fig. 8.



Whereas the modern representatives of the family are small and degenerate burrowing snakes, the largest less than a metre in length, the extinct Patagonian snake, judging by the size of its vertebræ, must have attained a length of at least two metres. It had a relatively large head, and probably resembled the modern Boas in habit.

This fossil evidently represents a hitherto unknown genus, which may be named *Dinilysia* and defined thus:—Marginal teeth of moderate size, about 14 or 15 in the maxillary series; palatine teeth relatively minute. Head rather large, the occipito-parietal region constituting half of the skull, with elevated sagittal crest; frontals longer than broad; small postfrontals present; prefrontals triangular, almost equilateral, only slightly in contact with nasals, which are long and narrow, tapering forwards. Vertebræ with low, delicate neural spines.

The type species, of which remains are now described, may be named *D. patagonica*, and defined by the minor characters of the head-bones already noted.

### III. JAWS OF A CARNIVOROUS DINOSAUR, *GENYODECTES SERUS*, gen. et sp. nov. (Plates XVIII. & XIX.)

Interesting evidence of an unknown large carnivorous Dinosaur is furnished by the fragmentary jaws of one individual obtained by Mr. Roth from red sandstone in the Cañadon Grande, Chubut. The bones and teeth are friable and much fractured, but the specimen comprises the premaxillæ, the greater part of the maxillæ and dentaries, and most of the teeth in position. The teeth are implanted in the bone in a single series, and all are invested with a rather thin layer of enamel. They are much laterally compressed, with an acute recurved apex, and finely serrated on the anterior and posterior margins. When they are broken across at the base, a small pulp-cavity is exposed. The specimen is shown, of one-half nat. size, from the right lateral aspect in one drawing (Plate XIX. fig. 1), while a front view of the premaxillæ is given in another (Plate XVIII. fig. 3).

The premaxillæ (*pma.*) are slightly displaced at their median symphysis, proving that they were not fused together; but their sutural connection with the maxillæ is not observable owing to fracture on the left side and displacement of the bone on the right. Each premaxilla is nearly as long as deep and its posterior upper portion is curved inwards, while antero-superiorly it rises into the slender, laterally compressed internarial bar which would meet the nasals. Its outer face is gently convex, and the snout, though bluntly rounded, must have been very narrow. There are no distinct indications of vascular foramina. The oral border bears four teeth, which are somewhat obliquely set and so crowded that they overlap each other. The foremost tooth is slightly smaller than the others; the second and third are taller and of nearly equal height; the fourth on the right side is shown to be shorter but broader. All these teeth are much broken; but it is

clear that they are gently recurved, and fragments show that the anterior border is serrated for more than half its length below the apex at least in the first and third teeth. No successional teeth are visible.

Of the maxilla (*mx.*) only the oral border and some of its teeth remain. That of the right side is most extensively preserved, and bears seven of its teeth in a rather fractured state. Its outer face is flattened and does not exhibit any large vascular foramina. Its inner face does not bear any palatal extension. The teeth are arranged in a moderately spaced series, and fixed in distinct sockets, of which the inner wall is as much elevated as the outer wall and does not exhibit any vertical clefts. All the teeth are much laterally compressed, with a median indentation on each side near the base; and their long diameter exactly coincides with the long axis of the maxilla. The apex of the fully extruded teeth is much recurved. The marginal serrations, as in the premaxillary teeth, are disposed at right angles to a tangent to the border; and in the fifth tooth at least they are shown to extend for considerably more than half the length of the anterior border from the apex. The posterior border of the fourth tooth displays serrations as far as its base. The middle teeth are especially large and elevated, the height of the fourth and fifth being about one and two-thirds times that of the fourth premaxillary tooth. All the teeth, indeed, are larger and more laterally compressed than those of the premaxilla. Successional teeth are shown to arise at the inner side of the base of the functional teeth. One has just displaced the third maxillary tooth on the left, and another the seventh maxillary tooth on the right; while the second right maxillary tooth is not completely extruded. No other successional teeth are seen.

The mandible is represented only by its anterior half or dentary region, which is nearly similarly preserved on both sides. The rami must have been very loosely united at the symphysis, the symphyseal facette being apparently narrow and smooth. The dentary bone (*d.*) is almost as deep as the premaxillæ and does not taper to the symphysis, where its inferior angle is rounded off, but probably less so than is indicated in the side view of the imperfect fossil. Its oral border must have been nearly straight, while its lower margin, which is satisfactorily preserved, seems to trend slightly downwards behind, where the bone becomes thinner. The teeth are shown to be inserted in complete and distinct sockets, with the inner wall as high as the outer wall, and neither cleft nor pierced by nutritive foramina. The upper inner border of the dentary bone itself, however, is much fractured and not well exposed; while the actual upper edge of the inner wall of the tooth-sockets is formed by a small and loosely-apposed, laterally compressed rod of bone (fig. 1 *a*, *spl.*), which doubtless corresponds with the curious anterior extension of the splenial described by Marsh in *Ceratosaurus*<sup>1</sup>. The teeth of the mandible are comparatively small, none being larger than those of the premaxilla.

<sup>1</sup> O. C. Marsh, "The Dinosaurs of North America" (16th Ann. Rep. U. S. Geol. Surv. 1896), p. 159.

The foremost pair at the symphysis is especially small, the tooth almost completely preserved on the right being only about two-thirds as high as the second tooth. Both these teeth are relatively thick, being compressed to a sharp edge only at their concave hinder border. The latter border seems to have been serrated quite to the base; but the anterior row of serrations scarcely extends more than halfway down the crown, and is slightly displaced from the median line towards the inner face of the tooth. The following teeth, so far as preserved, are more nearly bilaterally symmetrical, much compressed and indented near the base, with the anterior serrations also extending at least halfway down the crown. Except the third tooth on the left, and the fourth tooth on the right side, all are fully extruded and nearly equal in size; and no traces of successional teeth are exposed.

Simple compressed teeth, with more or less serrated edges, are common to all the genera of carnivorous Dinosauria, and it is difficult to discover diagnostic features solely in the jaws. Among known jaws of this type, however, it does not seem necessary to compare the new Patagonian specimen with any but those of *Megalosaurus* and *Ceratosaurus*—the former from Jurassic rocks in England, the latter from a corresponding geological formation in North America. If, as is commonly assumed, the number of teeth in the premaxilla may be regarded as a generic character, the fossil now described cannot be referred to *Ceratosaurus*, because the type species of this genus exhibits only three premaxillary teeth on each side<sup>1</sup>. In its possession of four premaxillary teeth, on the other hand, the Patagonian jaw agrees with that of *Megalosaurus*<sup>2</sup>; and it is difficult at first to perceive any essential differences between these two fossils. The upper anterior extension of the splenial bone has not hitherto been observed in *Megalosaurus*; but there is a vacant hollow in the known specimens which may have received it. There seem, however, to be important differences in the inner wall of the mandibular tooth-sockets and in the degree of development of successional teeth. Although the new specimen is somewhat fractured, the inner wall of the dentary completing the tooth-sockets appears to be continuous and as high as the outer wall; while in *Megalosaurus*, this inner wall consists only of low lappets divided at the middle of each tooth by a large cleft<sup>3</sup>. In the new specimen, moreover, very few successional teeth are exposed; whereas in *Megalosaurus* the apex of a successor is conspicuous at the base of nearly every functional tooth. These differences seem to necessitate the reference of the Patagonian Dinosaur to a new genus, *Genyodectes*; and its type species, represented by the jaw now described, may be named *Genyodectes serus*<sup>4</sup>. Unfortunately, nothing is known of the jaw which bore

<sup>1</sup> O. C. Marsh, *op. cit.* p. 158, pl. viii.

<sup>2</sup> R. Owen, *History of British Fossil Reptiles*, vol. iii. (1884), p. 169.

<sup>3</sup> R. Owen, *op. cit.* vol. i. p. 348, *Dinos. pls.* xxxiii., xxxiv.

<sup>4</sup> The so-called *Loncosaurus argentinus* (Ameghino, *Anal. Soc. Cient. Argent.* vol. xlvii. 1900, p. 61), a Megalosaurian from the Guaranitic Formation of the Rio Sehuén, is not yet defined or sufficiently described for comparison.

similar teeth during the Cretaceous period in the Northern hemisphere; but it seems probable that the completion of the tooth-sockets and the paucity of successional teeth in *Genyodectes* are characters indicating that it was one of the latest and most specialized members of its race.

#### IV. CONCLUSION.

The extinct reptiles discovered in the red sandstones of Northern Patagonia are now of special interest from two points of view. Firstly, there is a curious mixture of types which in other parts of the world belong to more than one geological period; secondly, the occurrence of *Miolania* seems to confirm the much-discussed theory of an old Antarctic continent and a former connection between South America and Australia.

The association of ancient with modern types of reptiles is especially remarkable. The nearest allies of the Crocodile *Notosuchus* occur in the Upper Jurassic of Europe, while the latest known Dinosaurs are undoubtedly Upper Cretaceous both in Europe and North America. *Miolania*, on the other hand, occurs in the latest Pleistocene deposits of Queensland, associated with extinct though typically Australian mammals; while the smaller species of the same genus found in Lord Howe's Island must be regarded as equally modern. *Dinilysia*, again, is a typical South American Snake, such as might have occupied an appropriate place in the fauna of that continent when the gigantic Glyptodonts and Ground-Sloths were flourishing. The anomaly may be explained either (i.) by supposing that the essentially Mesozoic land-reptiles survived to a later period in Patagonia than elsewhere; or (ii.) by assuming that geologists are mistaken concerning the age and apparent contemporaneity of some of the red sandstones of Neuquen and Chubut. The problem must be solved by future geological research.

Of all the similarities between the South-American and Australian faunas, perhaps none is more striking than the essential identity of the extinct *Miolania* in the two regions. There can be no doubt that this was a truly terrestrial or marsh Chelonian; while it seems at first highly improbable that so remarkably specialized a dermal armour as it possessed could be independently acquired by distinct animals in two different regions of the globe. The theory of a former land-connection between South America and Australia seems therefore to receive important support from the new discovery now described. It must, however, be remembered that during the late Mesozoic and early Cainozoic (Tertiary) periods, the Pleurodiran Chelonia had a much wider distribution than at present—were, in fact, perhaps nearly as cosmopolitan as are the Cryptodira in the existing world. It is known that the doubly-armoured Herring *Diplomystus*, now living in the rivers of Chile and New South Wales, was a widely distributed marine fish in the

Cretaceous period<sup>1</sup>. It is also known that the mud-fish *Ceratodus*, which now survives in Queensland rivers and once lived in Patagonia<sup>2</sup>, belongs to a race which was cosmopolitan in the Jurassic period. In these two cases, Australia and South America are proved to be merely remote refuges for old types which have been lost by extinction elsewhere. It is therefore just possible that, if the direct ancestors of *Miolania* were known, this remarkable Chelonian would prove to have originated not on any old Antarctic continent, but in some other region of the globe from which scattered survivors wandered into the lands now named South America and Australia respectively.

## EXPLANATION OF THE PLATES.

## PLATE XV.

*Miolania argentina* (pp. 170-172); cranium, upper aspect, one-third nat. size.—From Red Sandstone, Chubut, Argentine Republic. *occ.*, occipital crest; *orb.*, orbit; *i.-v.*, bony bosses.

## PLATE XVI.

*Miolania argentina* (p. 172); same cranium, lower aspect, one-third nat. size. *bs.*, basisphenoid; *i.pt.*, interpterygoid vacuity; *ot.*, otic bones; *p.na.*, palato-nares; *pt.*, pterygoid; *r.*, palatal ridge; *s.occ.*, supra-occipital; other letters as above.

## PLATE XVII.

Fig. 1. *Miolania argentina* (p. 171); same cranium with imperfect mandible, right lateral aspect, one-half nat. size. *au.*, auditory opening; *na.*, anterior nares; *s.*, hinder limit of horny beak; other letters as above.

1a. Ditto; oral aspect of mandible, one-half nat. size.

## PLATE XVIII.

Fig. 1. *Miolania argentina* (p. 173); right scapula, imperfect proximally, one-half nat. size. *t.*, tuberosity.

2. Ditto; bony ring of tail-sheath, posterior and right lateral (2a) aspects, one-third nat. size.

3. *Genyodectes serus* (p. 179); premaxillæ, anterior aspect, one-half nat. size.—From Red Sandstone, Chubut.

## PLATE XIX.

Fig. 1. *Genyodectes serus* (p. 179); imperfect jaws, right lateral aspect, one-half nat. size. *d.*, dentary; *mx.*, maxilla; *pmx.*, premaxilla.

1a. Ditto; two mandibular teeth of same specimen in position, inner aspect, nat. size. *d.*, dentary; *spl.*, anterior splenial extension.

<sup>1</sup> A. Smith Woodward, Catalogue of Fossil Fishes in the British Museum, pt. iv. (1901), pp. 140-144.

<sup>2</sup> F. Ameghino, Sinopsis Geologico-Paleontologica—Suplem. (1899), p. 10.

## PLATE XX.

Fig. 1. *Dinilysia patagonica* (pp. 176-179); imperfect skull and mandible, upper and left lateral (1a) aspects, with oral aspect of right maxilla (1b) and fractured quadrate bone (1c), nat. size.—From Red Sandstone, Neuquen. *ag.*, angular; *d.*, dentary; *ec.*, ectopterygoid; *ex.occ.*, exoccipital; *fr.*, frontal; *mx.*, maxilla; *na.*, nasal; *nar.*, external narial opening; *o.*, projecting otic bone; *op.*, opisthotic; *orb.*, orbit; *pa.*, parietal; *pr.f.*, prefrontal; *pr.o.*, pro-otic; *pt.*, pterygoid; *pt.f.*, postfrontal; *qu.*, quadrate; *r.*, lateral ridge on parietal; *s.occ.*, supraoccipital; *s.t.*, supratemporal; *x.*, fracture.

2. Ditto; portion of vertebral column of same specimen, nat. size. *n.*, neural spine; *r.*, rib.

All the original specimens are preserved in the La Plata Museum.

2. Note on the Innervation of the Supraorbital Canal in the Cat-fish (*Chimæra monstrosa*). By R. H. BURNE, B.A., F.Z.S., Anatomical Assistant in the Museum of the Royal College of Surgeons.

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(Text-figure 49.)

An excellent historical *résumé* of the work that has hitherto been done upon the comparative anatomy and more particularly the innervation of the organs of the lateral line, with a discussion of the morphological conclusions that may be drawn from them, is to be found in two recent papers by Cole<sup>1</sup>, so that for the purposes of this note it will be amply sufficient to briefly sketch certain ascertainment facts with regard to the innervation of this sensory system. It has now been shown in several instances that the nerves that supply the lateral-line organs have no real relation to the cranial nerves in whose company they leave the brain, but arise within the brain in common with the auditory nerve from a particular centre—the tuberculum acusticum. Furthermore in almost all cases, when sufficient care is used in the examination, the lateral-line nerves are found to enter into a definite and constant relationship with certain of the cranial nerves. Thus the lateral-line nerve that supplies the supraorbital canal forms the Ramus ophthalmicus superficialis of the VIIIth cranial nerve, that for the suborbital canal constitutes the R. buccalis VII, and that for the hyomandibular canal the Ramus hyomandibularis VII; while the main lateral canal of the trunk is innervated by the lateralis branch of the vagus. Although this connection of the lateral-line nerves with the VIIth and Xth cranial nerves only is almost universal, it is not so in every case. For instance, in many

<sup>1</sup> Cole: "Observations on the Structure and Morphology of the Cranial Nerves and Lateral Sense-organs of Fishes," Trans. Linn. Soc. vii. 1898, p. 187; and "On the Cranial Nerves of *Chimæra monstrosa*," Trans. R. Soc. Edinb. xxxviii. 1897, p. 635.